EFFICACY OF BENZOCAINE AS AN ANESTHETIC FOR JUVENILES *PIMELODUS CLARIAS MACULATUS* (PISCES, PIMELODIDAE)

María Julieta Parma de Croux [1]
Marcela Montagna [2]

ABSTRACT

The effect of anesthetic benzocaine in *Pimelodus clarias maculatus* (Lacépede, 1803) juveniles using concentrations of 1:20,000; 1:15,000 and 1:10,000 at 20 and 25°C in individuals from 9.1 to 76.5 g in weight, was evaluated. Experiments showed that the optimum dose to obtain a complete stage of sedation was 1:10,000 at 20 and 25° C, which insure a rapid and effective anesthesia as well as enough time for comparative procedures.

KEYWORDS. Anesthesia, benzocaine, temperature, juveniles, *Pimelodus clarias maculatus.*

INTRODUCTION

Anesthetics have been used on fishes for experimental operations, and in fisheries work for weighing, measuring, stripping and spawning, fin clipping and marking, and general handling. In aquaculture and fisheries works can be considered for use under common farming procedures and transport conditions (McFarland, 1960). Tricaine methanesulfonate (MS-222) is the commonly used anesthetic on fish (Plumb **et al.**, 1983; Jeney **et al.**, 1986; Gilderhus **et al.**, 1991), but in several countries these chemicals are expensive and not always available. Benzocaine was identified as one of the best candidates among 16 anesthetics tested by Gilderhus & Marking (1987). It was suggested as an acceptable substitute for MS-222 by McErlean & Kennedy (1968) who reported that it acts more rapidly and at lower concentrations than MS-222. Benzocaine is very effective and reasonably priced and has a history for use in human applications.

The "bagre amarillo", *Pimelodus clarias maculatus* (Lacépede, 1803), a species having a wide geographical distribution in South America (Fowler, 1951; Ringuelet **et al.**, 1967), is considered to be a great commercial and sporting importance in Argentine litoral. Early trials showed that *P.c.maculatus* has some

1. Instituto Nacional de Limnología (INALI - CONICET), José Maciá 1933, (3016) Santo Tomé (Santa Fe), Argentina.
2. Facultad de Formación Docente en Ciencias, Universidad Nacional del Litoral, 9 de Julio 2655, (3000) Santa Fe, Argentina.

attributes that would allow to consider it as a new neotropical species for aquaculture practices PARMA DE CROUX, 1986).

The objective of the study was to evaluate the anesthetic potency of benzocaine for use on juveniles *P.c.maculatus* and determinate effective and safe concentrations and exposure times.

MATERIAL AND METHODS

The experimental fish were seined from water bodies of the Salado River (Santa Fe Province, Argentina, 31° 41'S and 60°42'W) and were acclimated to laboratory conditions. They were fed daily with commercial pellet containing 40% crude protein, but they were not fed for at least 24 h prior to each experiment. Benzocaine (Ethyl-p-Aminobenzoate) was dissolved in a minimum quantity of ethanol; the stock solution was used to prepare the tested concentrations (1:20,000; 1:15,000 and 1:10,000). Tests were performed at 20 and 25°C. Fish weighing between 9.1 and 76.5 g were placed in seven litres aquaria individually and anesthetized. Ten (10) tests were carried out for each concentration and temperature.

Behavioural responses of fish to benzocaine were used to determine from major levels of anesthesia similar to those described by MCFARLAND (1960): Stage I (Plane 1), light sedation; Stage I (Plane 2), deep sedation; Stage II (Plane 1), partial loss equilibrium; Stage II (Plane 2), total loss equilibrium; Stage III, loss of reflex reactivity; and Stage IV, medullary collapse.

Anesthesia induction time was measured from the moment of addition of the anesthetic to the aquarium water until the fish reached Stage III (total loss of reactivity). Thereafter, under similar temperature and oxygen conditions fish were immediately weighed, measured, and transferred to fresh water. Recovery time was the time recorded for removal of the anesthetized fish from the aquarium until they regained normal swimming ability. Elapsed time from exposure to full anesthesia was no greater than 25 minutes. Fish were observed for 48 hours after each trial to assure their normal behaviour.

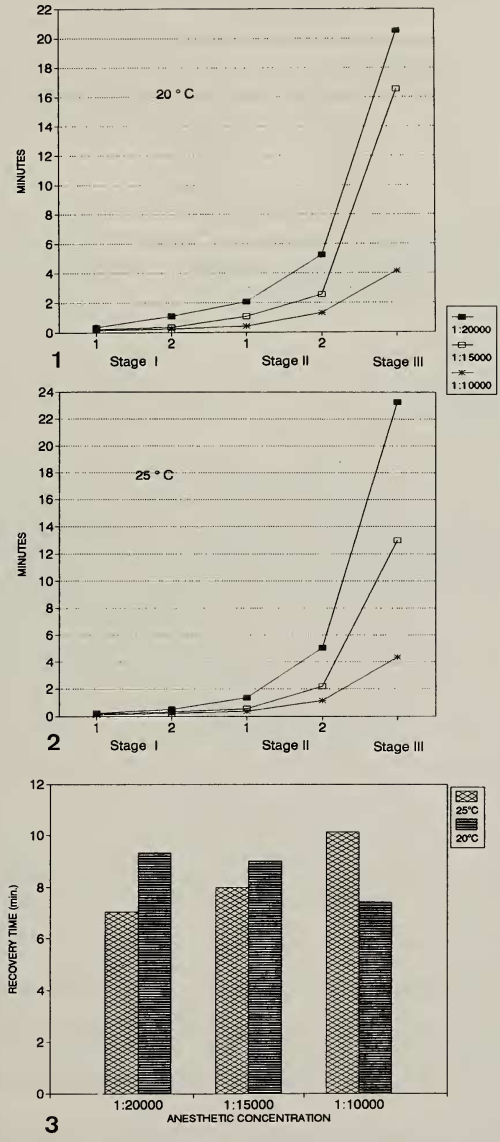
RESULTS

Fish exposed to a concentration of 1: 20,000 at 20° C and 25°C exhibited no strong response (tab. I, figs. 1, 2). They were totally anesthetized (Stage III) at 21 minutes (20°C) and 23 minutes (25°C). Some of the specimens did not reach Stage III during the 25 minutes of the tests and they reacted to external stimuli. Complete recovery was attained in 9 and 7 minutes for 20° and 25°C, respectively (fig. 3).

Benzocaine at 1: 15,000 (20°C) reached Stage II-Plane 2 (total loss of equilibrium) at 2' minutes 52" and the Stage III, with loss of reflex reactivity at 16' minutes 53". With this concentration, but at 25°C, Stage II-Plane 2 anesthesia started at 2' minutes 20" and the specimens were totally anesthetized (Stage III) at 13 minutes. The time required for total recovery were very similar for both temperatures (fig 3).

Fish exposed to the highest concentration of benzocaine tested (1:10,000) at 20° C and 25°C were totally anesthetized (Stage III) after 4' minutes 35" and 4' minutes 17", respectively; they showed a total loss of reactivity, and respiratory movements were slower. In this condition the juveniles of *P. clarias maculatus* were limp and could be easily handled. Placed into fresh water they recovered the equilibrium and began to swim within 7 minutes at 20°C and 10 minutes at 25°C (fig 3). In all fish tested at both temperatures, no mortality was registered during the anesthetization, recovery, or the subsequent observation period (48 h), where all specimens exhibited normal feeding and behaviour.

The results indicate that, within the limits of size used in the experiments,



Figs. 1-3. 1, Anesthetic potency of benzocaine in *Pimelodus clarias maculatus* at 20°C; each point represents mean values of 10 replicates (tests with individual fish); 2, Anesthetic potency of benzocaine at 25°C; each point represents mean values of 10 replicates (tests with individual fish); 3, Recovery times (min.) of juveniles exposed to three concentrations of benzocaine and two temperatures (20 and 25° C).

Table I. Times (means and standard deviation) to reach Stage III of sedation using benzocaine as anesthetic in juveniles of *Pimelodus clarias maculatus*.

	TEMP. 20°C			TEMP. 25°C	
CONCENTRATION	MEAN	SD	CONCENTRATION	MEAN	SD
1:20,000	21'18"	3'10"	1:20,000	23'35"	2'12"
1:15,000	16'53"	3'05"	1:15,000	13'24"	2'07"
1:10,000	4'35"	1'04"	1:10,000	4'17"	1'26"

the induction of anesthetic appears to be independent of size of fishes. The data suggest no significant correlation between the time of Stage III and weight of fishes ($r= 0.229$; $P<0.001$ for 20° C and $r= 0.095$; $P<0.001$ for 25° C). At highest concentration (1:10,000) the time required to induce total anesthesia (Stage III) were very similar for both temperatures, then its effects were negligible. Table 1 show the times (means and standard deviations) required to reach Stage III of sedation at different concentrations used.

Benzocaine proved to be an effective anesthetic for *P.clarias maculatus*. The results clearly show that the response of fish is dose - dependent. Specific depths of anesthesia can be controlled in specimens by careful manipulation of the concentration of anesthetic in the medium.

The best concentration was 1:10,000 for 20-25° C. Rapid loss of equilibrium as well as reflex reactivity, make these stage desirable for operations, marking and tagging and the handling of fishes. Under full anesthesia, fishes can be moved for 5 minutes without negative effects. Concentrations about 1:20,000 are desirable for transport of fishes. It must be emphasized that the data reported here represent a preliminary investigation only, and further studies are needed to fully evaluate benzocaine as an anesthetic in this species to adult specimens.

REFERENCES

FOWLER, H. W. 1951. Os peixes de água doce do Brasil. **Archos Zool. Est. S. Paulo**, São Paulo, **6**: 1- 625.

GILDERHUS, P. A & MARKING, L. L. 1987. Comparative efficacy of 16 anesthetic chemicals on rainbow trout. **N. Am. J. Fish. Mgmt**, Bethesda, **7**: 288-292.

GILDERHUS, P.A; LEMM, C.A & WOODS III, L.C. 1991. Benzocaine as an anesthetic for Striped Bass. **Prog. Fish Cult**, Bethesda, **53**: 105- 107.

JENEY, Z.; JENEY,O.; OLAH, J. **et al.** 1986. Propanidid, a new anaesthetic for use in fish propagation. **Aquaculture**, Amsterdam, **54**: 149-156.

MCERLEAN, A.J. & KENNEDY, V.S. 1968. Comparison of some anesthetic properties of benzocaine and MS- 222. **Trans. Am. Fish. Soc.**, Bethesda, **97**: 496-498.

MCFARLAND, W.N. 1960. The use of anesthetics for the handling and the transport of fishes. **Calif. Fish Game**, Sacramento, **46**: 407- 431.

PARMA DE CROUX, M.J. 1986. Crecimiento de juveniles de *Pimelodus clarias maculatus* (Lac.) (Pisces, Pimelodidade) con diferentes raciones de alimento balanceado. **Lat. Acuicultura**, Lima, **29**: 13-40.

PLUMB, J. A.; SCHWEDLER, T. E. & LIMSUWAN, CH. 1983. Experimental anesthesia of three species of freshwater fish with Etomidate. **Prog. Fish Cult.**, Bethesda, **45**(1): 30-33.

RINGUELET, R.; ARAMBURU, R. & ALONSO DE ARAMBURU, A. 1967. Los peces argentinos de agua dulce. **Com. Inv. Cient. Pcia. Bs. As**, La Plata, **1**: 1-602.

Recebido em 08.01.1997; aceito em 15.10.1997.